

Noise Hunting in Advanced LIGO

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The Laser Interferometer Gravitational-wave Observatory (LIGO) is designed to detect gravitational waves from energetic astrophysical sources in the universe. During its first observing run, LIGO detected two gravitational wave signals from binary black hole mergers, opening up a new path to astronomy. In order to improve LIGO's detection rate, continuous efforts are made to characterize sources of noise and thereby improve LIGO's sensitivity. This project investigated ground motion as a source of non-linear noise at the LIGO observatories. We observed that high winds with an excess velocity of 20 mph have an impact on the Alignment Sensing and Control (ASC) control loops. We found an increase in ASC noise amplitude at three distinct frequency bands. Time frequency analysis indicated the prevalence of glitches, or transient noise, with a central frequency of 5 Hz during periods of high wind. These results will enable commissioners to isolate and eliminate this effect, improve data quality, and enhance the interferometers' performance and stability.